

MST124

TMA 01

2018J

Covers Units 1 and 2

Cut-off date 07 November 2018

You can submit this TMA either by post to your tutor or electronically as a PDF file by using the University's online TMA/EMA service.

Before starting work on it, please read the document *Student guidance for preparing and submitting TMAs*, available from the 'Assessment tab' of the MST124 website.

The work that you submit should include your working as well as your final answers.

Your solutions should not involve the use of Maxima, except in those parts of questions where this is explicitly required or suggested. Your solutions should not involve the use of any other mathematical software.

Your work should be written in a good mathematical style, as described in Section 6 of Unit 1, and as demonstrated by the example and activity solutions in the study units. Two marks (referred to as good mathematical communication, or GMC, marks) on this TMA are allocated for how well you do this.

Your score out of 2 for GMC will be recorded against Question 6. You do not have to submit any work for Question 6.

Question 1 – 15 marks

You should be able to answer this question after studying Unit 1.

(a) Simplify the expression

$$\frac{3(2a^3 - 4b)(2a^3 + 4b)}{4b^2 - a^6}. \quad [3]$$

(b) Rationalise the denominator in the following expression, simplifying your answer as far as possible:

$$\frac{3\sqrt{5} - \sqrt{2}}{\sqrt{2} - \sqrt{5}}. \quad [3]$$

(c) Simplify the expression

$$\frac{(4x)^{1/2} x^{9/4}}{\sqrt{2x^5}}. \quad [3]$$

(d) Solve the equation

$$\frac{3}{x-4} + \frac{5}{3x+2} = 0. \quad [3]$$

(e) Rearrange the following equation to make r the subject, where $r > 0$ and $M > 0$:

$$\frac{4\pi^2}{G^4 M} = \frac{T^4}{r^2}. \quad [3]$$

Question 2 – 8 marks

You should be able to answer this question after studying Unit 1.

Consider the following TMA question and a student's attempt at a solution.

Question

Sally is holding a party to celebrate her 40th birthday. She has a choice of two venues. Venue one costs £45 to hire and charges £9.50 per person for food. Venue two is free to hire, but charges £13 per person for food. If Sally expects 50 people to come to her birthday party, which venue is cheaper?

Solution

$$y = 45 + 9.5x$$

$$= y = 45 + 9.5 * 50 = 45 + 475 = 520.$$

$$y = 13 * 50 = 650, \text{ so venue one.}$$

(a) Criticise the solution, explaining why it is difficult to follow. [3]

(b) Write out a better solution. [5]

Question 3 – 10 marks

You should be able to answer this question after studying Unit 2.

- (a) Show that the point $(3, -\frac{38}{5})$ lies on the line with equation $5y = 7 - 15x$. [1]
- (b) Find the equation of the line that has a gradient of 3 and passes through the point $(4, 5)$. [2]
- (c) Draw the line that you found in part (b) and the line with equation $5y = 7 - 15x$ on the same set of axes. (You should draw this by hand rather than using any software.) [2]
- (d) Use your graph to estimate the coordinates of the point of intersection of the two lines, quoting them to the nearest integer. [1]
- (e) By solving the equations of the two lines simultaneously, find the exact coordinates of this point of intersection. [4]

Question 4 – 10 marks

You should be able to answer this question after studying Unit 2.

- (a) Solve the equation
$$\frac{3x + 5}{2x} + \frac{7}{x - 2} = 0.$$
 [2]
- (b) Using the strategy described in Section 4.9 of Unit 2 in Book A, sketch the graph of $y = (x + 3)(1 - x)$. [2]
- (c) Bert is standing on a level playing field and he kicks a ball into the air from the ground at his feet. The trajectory of the ball can be modelled by the equation

$$y = 2x - \frac{x^2}{3},$$

where x is the horizontal displacement (in metres) of the ball from Bert and y is the vertical displacement (in metres) measured from the ground.

- (i) Find the maximum vertical displacement of the ball. [3]
- (ii) If Henry is standing 5.5 metres away from Bert, in the direction the ball is travelling, how high should Henry hold his hands above the ground in order to catch the ball? Explain your answer. [3]

Question 5 – 5 marks

You should be able to answer this question after studying the Computer Algebra Guide, up to the end of Section 3.

You should use the computer algebra package Maxima to do each part of this question. Include a printout or screenshot of your Maxima worksheet with your solutions. You are not expected to annotate your Maxima worksheet with explanation. However, please remember that for good mathematical communication you should present your answers clearly.

- (a) Find the exact solutions of the equation

$$2x^4 - 7x^3 - 19x^2 + 42x + 72 = 0. \quad [2]$$

- (b) Plot the graph of the equation

$$y = 2x^4 - 7x^3 - 19x^2 + 42x + 72.$$

Choose suitable ranges for x and y on the graph to show the graph crossing the x -axis at the values that you found in part (a). [3]

Question 6 – 2 marks

A score out of 2 marks for good mathematical communication over the entire TMA will be recorded under Question 6.

You do not need to submit any work for this question. [2]

Your mathematical background (*optional*)

Your tutor currently knows very little about you. You might like to take this opportunity to share with your tutor some details of your mathematical background and your feelings about the work that you have done so far in the module. For example, you could write three or four lines on each of the following.

- A brief indication of your previous mathematical knowledge, for example: ‘failed GCSE maths’, ‘studied at A level but did not take the exam’, ‘passed a HND that included maths’.
- Two mathematical topics that you felt confident about at the start of the module, and two that caused you concern. Describe how you feel about these four topics now. Give reasons for your answers.

Providing this information may help your tutor to support you better, but no marks are awarded for it.

Taking stock of where you are

The start of your module is an opportune time to reflect on your learning and education, personal, career and professional development. This will help you to explore your study journey and identify areas of strengths and areas for further support or development. Personal Development Planning (PDP) will help you to step back and consider where you are, where you want to be and how you will achieve your goals. Many people find it difficult to reflect on their own performance, especially if they know that things haven’t progressed very well. We can always learn from our mistakes and build on our past experiences.

If you are studying for career purposes, it is essential that you are able to market yourself to potential or current employers by reflecting and identifying the skills developed throughout your study.

To get you started, you may like to explore resources available on the Careers Advisory Service website:

Career Planning <https://help.open.ac.uk/career-planning>

Personal Development Planning <https://help.open.ac.uk/pdp>

You can manage your own learning and development by planning and preparing for your study ahead. Only you know your own learning style and what you want to achieve at the end of this module. You can start identifying where you may like further support or need further information so that you can begin to set clear goals for your study.
